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WESTERN EQUINE AND ST. LOUIS ENCEPHALITIS IN MAN

CALIFORNIA, 1945-1950 *

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W. ALLEN LONGSHORE, M.D., Bureau of Acute Communicable Diseases

SUMMARY

A group of etiologic agents, some known and some unknown, produce in man a clinical syndrome now labeled "infectious encephalitis."

The separation, from this larger group, of single disease entities which cause similar clinical symptoms is possible, but calls for diagnostic acumen plus supporting laboratory evidence. Two etiologically specific entities, western equine encephalitis and St. Louis encephalitis, are frequently encountered in rather well-defined areas of California, the Central Valley and Imperial Valley; and there is a definite seasonal pattern of occurrence—June through October. There are certain guides that are helpful in differential diagnosis. Establishing a diagnosis on the basis of clinical evidence is difficult. Laboratory studies are of great importance not only for diagnosis in the individual case but for advancement of etiology. Specimens are worthless unless taken at proper intervals and submitted by methods described.

It is probable that encephalitides caused by still unknown agents exist in California. The isolation and identification of new encephalitogenic viral agents will depend in large measure upon the submission by physicians of suitable specimens from patients with central nervous system disease in which the cause is obscure.

This article appears in two parts. The second part, relating to clinical aspects, laboratory diagnosis, treatment, prognosis, and prevention, will appear in the next issue.

The term infectious encephalitis is a broad clinical one which refers to an inflammation of the brain produced by a living agent.

In public health morbidity reporting, "infectious encephalitis" is commonly used in a more restricted sense, and theoretically includes only the so-called arthropod-borne viral encephalitides occurring in this Country —eastern and western equine encephalomyelitis and St. Louis encephalitis, and von Economo's disease.† In practice, however, physicians commonly report in this category, in addition to the above diseases, not only those encephalitides presumed to be infectious in origin, and for which the etiologic agent has not yet been defined, but also those encephalopathic conditions secondary to infectious processes of known causes, such as mumps, measles, varicella, and influenza. The present report is concerned primarily with "infectious encephalitis" caused by one or the other of two viral agents, namely, the viruses of western equine encephalomyelitis and of St. Louis encephalitis.

Infection of man with western equine encephalomyelitis virus was first recognized in 1938 in California;[6,7] prior to that time the virus was considered to produce a disease only in horses since the virus was first isolated from this species,[9] in which it had produced extensive epizootic disease.

Human infection with the St. Louis virus was first recognized in St. Louis, Mo., in 1933.[10] In California, serologic evidence of human infection was reported in 1939 by Howitt,[7] and the virus was isolated for the first time in this area from a fatal human case in 1945 by Lennette.[8] In the years following the recognition

* Presented before the section on General Medicine at the 80th Annual Session of the California Medical Association, Los Angeles, May 13-16, 1951. Reprinted here from *California Medicine*, September, 1951, by permission of California Medical Association.

† This is in conformity with the classification established by the American Public Health Association.[1]

UNIV. OF MICH.

that these agents could cause infection of man, human illness attributable to these viruses has been found to be relatively common.

The purpose of the present communication is to summarize certain observations concerning epidemiologic and clinical aspects of encephalitis caused by these two specific agents.

EPIDEMIOLOGIC CHARACTERISTICS

Prevalence

During the six-year period from 1945 through 1950 a total of 1,251 cases of encephalitis was reported to the State Department of Public Health (Table 1). Of this total, 154 cases were classified as "other encephalitides," i.e., they were postinfectious or postvaccinal types. There remained, therefore, a residue of 1,097 cases which were thus allocated to the "infectious encephalitis" category, which by definition should include only the arthropod-borne viral encephalitides and von Economo's disease, but in actual practice includes a diverse group of encephalopathic conditions of unknown cause.

TABLE 1

Distribution, by Year, of 1,251 Reported Cases of Encephalitis, California, 1945-1950

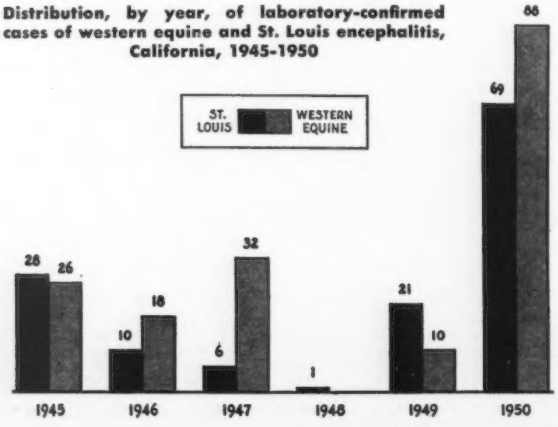
Year	Total cases all encephalitides	Total cases recorded as "infectious encephalitis"*	Laboratory-confirmed cases of western-equine and St. Louis encephalitis			Total cases recorded as "other encephalitides"†
			Total	W. E. E.	St. Louis enceph.	
1945	311	302	54	26	28	9
1946	177	160	28	18	10	17
1947	141	127	38	32	6	14
1948	75	71	1	0	1	4
1949	128	80	31	10	21	48
1950	419	357	157	88	69	62
Totals	1,251	1,097	309	174	135	154

* See text for definition.

† This category includes encephalitis following infection with such agents as the viruses of rubeola, varicella, mumps, herpes, influenza, etc., and the postvaccinal encephalopathies.

CHART 1

Distribution, by year, of laboratory-confirmed cases of western equine and St. Louis encephalitis, California, 1945-1950



There was wide variation from year to year in the number of cases of "infectious encephalitis" reported. The incidence was highest in 1945 and 1950, when 302 and 357 cases, respectively, were reported. The lowest number of cases reported was 71, in 1948.

Of the 1,097 cases in the "infectious encephalitis" grouping, 309 (28 percent) were determined by laboratory methods to be caused by the western equine or St. Louis viruses (see Table 1 and Chart 1). Laboratory studies were not done in all instances, and it would appear probable that had blood specimens been available for examination in more of these reported cases, these viruses might have been found to be the infecting agents in additional instances. For example, in 1950, a total of 357 cases of "infectious encephalitis" was reported. Serologic tests were done on blood specimens available from 272 of these patients and 157 (58 percent) of them had serologic evidence of current clinical infection with the St. Louis or western equine viruses. In addition, the fact that the blood of the remaining 115 patients was negative for these viruses * indicates that an appreciable proportion of patients (42 percent of 272 tested) who were classified as having "infectious encephalitis" actually had a clinical condition caused by some other agent and suggests the possible existence of other neuro-tropic viruses as yet unrecognized.

Geographic Distribution

Figure 1 gives the geographic distribution, by county, of 1,078 reported cases of "infectious ence-

* Either specific antibodies did not develop or there was no rise in antibody titer during the course of the illness.

FIGURE 1

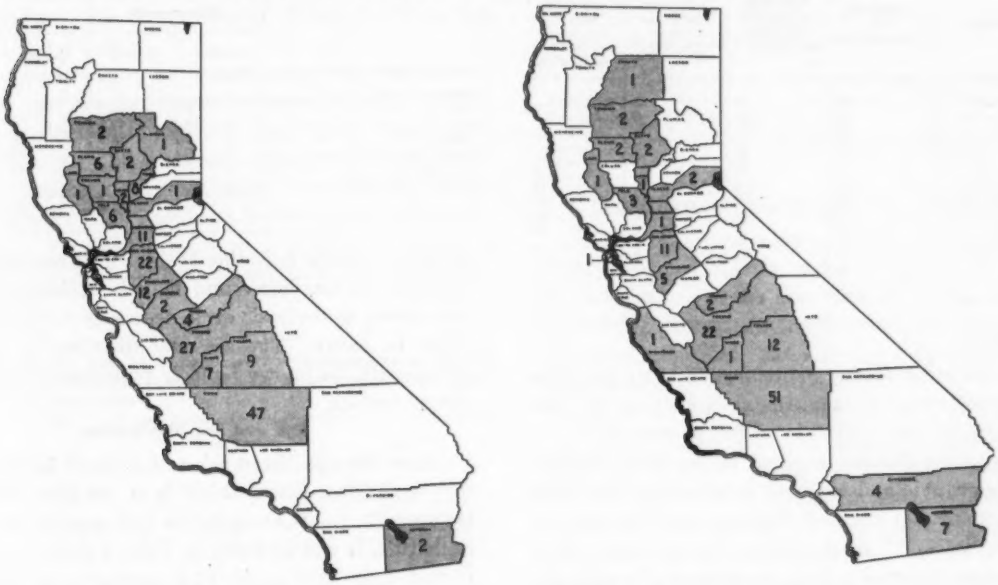
Geographic distribution, by county, of 1,078 reported cases of "infectious encephalitis," California, 1945-1950

(Shaded areas indicate counties in which laboratory-confirmed cases of western equine or St. Louis encephalitis occurred.)

FIGURE 2

DISTRIBUTION, BY COUNTY, OF 173 LABORATORY-CONFIRMED CASES OF WESTERN EQUINE ENCEPHALITIS (LEFT MAP) AND 132 CASES OF ST. LOUIS ENCEPHALITIS (RIGHT MAP), CALIFORNIA, 1945–1950

(Does not include one case of western equine and three of St. Louis encephalitis which could not be allocated by county.)



phalitis" during the period 1945-1950.† The cases have been allocated by county in which infection presumably occurred. It will be noted that cases were reported from 46 of the 58 counties in California. The preponderance, however, was reported from the Central Valley areas, with the largest number in Kern, Fresno, San Joaquin, and Tulare Counties.

In a comparison of Figure 1 with Figure 2 it will be noted that laboratory-proved cases of western equine and St. Louis encephalitis, which are included in the "infectious encephalitis" category, appear by and large to be confined to the Central and Imperial Valleys. These proved cases of western equine and St. Louis encephalitis have been reported from only 23 counties of the State (Figure 1).

The geographic distribution within the State is limited, essentially, to the hot, irrigated agricultural sections of the Central and Imperial Valleys, and in all probability reflects the distribution of the known mosquito vectors.

Seasonal Distribution

The restriction of the occurrence of cases of these two encephalitides to a definite season is rather striking, as can be seen from Table 2 and Chart 2. On the other hand, it will be noted that cases of "encephalitis" (without regard to infecting agent) occur in every month of the year; and, if the category is narrowed to include only reported cases of "infectious encephalitis," this year-round pattern still obtains. The occurrence of a pronounced increase in the number of cases reported during the months of June through October, with the highest incidence during July, August and September, is also brought out in Table 2 and Chart 2. If consideration of seasonal occurrence is confined to laboratory-confirmed cases of St. Louis and western equine encephalitis, the limited period of incidence is particularly evident; laboratory-confirmed cases occurred only during the months of June through October. This seasonal distribution suggests that cases which are diagnosed as "infectious encephalitis" during the period November through May are not caused by the western equine or the St. Louis viruses, but are attributable to some other causal agent or agents. The seasonal distribution also coincides with the seasonal variations in the numbers of the arthropod vectors.

The difference in seasonal incidence of western equine encephalitis when compared with that of St. Louis encephalitis is also of interest. Two rather distinct waves are apparent. Chart 2 and Table 3 illustrate this point. Western equine encephalitis, in general, usually appears a month earlier than St. Louis encephalitis, and reaches its peak in July, with 80 percent of the cases occurring by the end of August. St. Louis encephalitis, in contrast, appears somewhat later, and usually reaches its peak in September, with 60 percent

† Table 1 gives data on a total of 1,097 cases of "infectious encephalitis" reported. Figure 1, however, covers only 1,078 cases, since 19 were in transient workers and hence could not be allocated to any specific county.

TABLE 2

Distribution, by Month of Onset, of 1,251 Reported Cases of Encephalitis, California, 1945-1950

Month of onset	Total cases, all encephalitides	Total cases recorded as "infectious encephalitis"*	Total cases recorded as "other encephalitides"*	Laboratory-confirmed cases of west. equine and St. Louis encephalitis
January	43	31	12	----
February	32	24	8	----
March	34	22	12	----
April	33	24	9	----
May	39	29	10	----
June	71	48	23	9
July	241	219	22	78
August	315	299	16	107
September	249	241	8	94
October	82	75	7	21
November	43	34	9	----
December	33	26	7	----
Not stated	36	25	11	----
Totals	1,251	1,097	154	309

* See Table 1.

of cases occurring during September and October. This temporal difference in incidence suggests that the viral agents may be transmitted by different vectors.

Some of the factors involved in the determination of the geographic and seasonal distribution have been established by the work of Hammon and Reeves and their associates [3,4,5] in the Kern County area. These investigators reported certain mosquitoes (for example, *Culex tarsalis*) are the vectors mainly responsible for the transmission of western equine and St. Louis encephalitis in California, and they suggested that the

CHART 2

SEASONAL DISTRIBUTION OF ENCEPHALITIS IN CALIFORNIA, 1945-1950

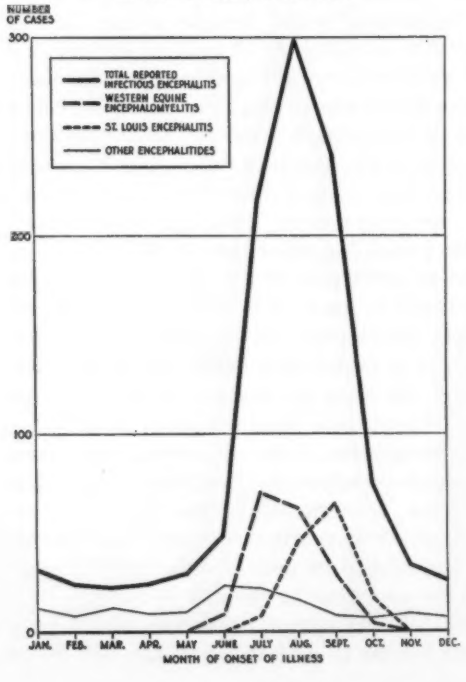


TABLE 3

Distribution, by Month of Onset, of 309 Laboratory-confirmed Cases of Western Equine and St. Louis Encephalitis, California, 1945-1950

	Western equine		St. Louis	
	Number	Percent	Number	Percent
January to May	----	----	----	----
June	9	5.2	----	----
July	70	40.2	8	5.9
August	62	35.6	45	33.3
September	29	16.7	65	48.2
October	4	2.3	17	12.6
November-December	----	----	----	----
Totals	174	100.0	135	100.0

probable natural infection cycle is bird-mosquito-bird; infection in the horse and man is accidental and is extraneous to the basic cycle necessary to maintain the agent in nature. The seasonal distribution observed agrees with the known biologic requirements of the reported vectors.

Age and Sex Distribution

As to the age distribution of patients in the laboratory-confirmed cases, there is a striking difference between St. Louis encephalitis and western equine encephalitis. It will be noted in Table 4 that in a six-year period only two cases (1.5 percent) of St. Louis encephalitis occurred in persons under one year of age, whereas 35 (20.1 percent) of the patients with western equine encephalitis cases were in this age group. The reason for this difference is not yet clear. One explanation might be that since inapparent or subclinical infection with the St. Louis virus is more widespread than is similar infection with the western equine virus,[6] more persons are immune to the former than to the latter equine virus. Consequently, more newborn children might have immunity (by reason of passive transfer of antibody from the mother) to one agent than to the other.

The relative incidence of St. Louis and western equine encephalitis in infants is reversed in the 20-29 and 30-39 year age groups. Of the proved cases of St. Louis encephalitis, 17.8 percent occurred in the 20-29

TABLE 4

Distribution, by Age of Patient, of 309 Laboratory-confirmed Cases of Western Equine and St. Louis Encephalitis, California, 1945-1950

Age	Western equine		St. Louis	
	Number	Percent	Number	Percent
Under 1 year	35	20.1	2	1.5
1- 4	26	14.9	20	14.8
5- 9	16	9.2	16	11.8
10-19	24	13.8	25	18.5
20-29	10	5.7	24	17.8
30-39	13	7.5	19	14.1
40-49	17	9.8	11	8.2
50 and over	33	19.0	18	13.3
Totals by type	174	100.0	135	100.0

age group and 14.1 percent in the 30-39 group; comparable figures for western equine encephalitis are 5.7 percent and 7.5 percent respectively

With the exceptions mentioned, the occurrence of both diseases was fairly evenly distributed over the various age groups.

In the laboratory-confirmed cases there were about twice as many male patients as female (Table 5). This perhaps reflects a difference in opportunity of exposure, which, in turn, is dependent upon occupation. Such an explanation is not fully satisfactory, however, since the difference in incidence as between sexes is equally evident in the childhood group, in which differences in opportunity for exposure are not so clearly related to occupation.

TABLE 5

Distribution, by Sex of Patient, of 309 Laboratory-confirmed Cases of Western Equine and St. Louis Encephalitis, California, 1945-1950

Sex	Western equine		St. Louis	
	Number	Percent	Number	Percent
Male	121	69.5	85	63.0
Female	53	30.5	50	37.0
Totals	174	100.0	135	100.0

Rural and Urban Distribution

Risk of infection with the two viruses under consideration appears to be greater under rural than under urban living conditions. Thus, in 1950, of the 157 laboratory-proved cases of encephalitis, 113 were in residents of rural areas, and the remaining 43 were in urban residents.

The extra hazard presumably inherent in the rural areas may be referable to the absence of, or less effective, mosquito control and to the increased exposure to the vector which is a concomitant of the conditions under which agricultural laborers work and live.

(To be continued in next issue)

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Quaternary Compounds Approved

Two more quaternary ammonium compounds have been approved by the State Department of Public Health for use in the bactericidal treatment of eating and drinking utensils. They are *alkyl benzyl benzyl dimethyl ammonium chloride* and *alkyl tolymethyl trimethyl ammonium chloride.*

With the new additions, the list now includes 15 quaternary ammonium compounds approved by the department under provisions of the California Restaurant Act of 1947. Approval of a new compound is based on examination by the department of evidence submitted by the manufacturer as to the compound's effectiveness and toxicity, and by independent studies in the department's laboratory.

Dr. Lennette on Expert Panel

Edwin H. Lennette, M.D., Chief, Viral and Rickettsial Disease Laboratory, has been asked by the World Health Organization to serve as a member of the WHO Expert Advisory Panel on Influenza. Members of expert committees are expected to advise WHO on important developments in their own subjects, and particularly in respect to such developments in the territory in which they are working. The Viral and Rickettsial Disease Laboratory of the State Department of Public Health serves as a regional laboratory for WHO's Influenza Study Program.

Third Species of Chiggers Found to Attack Man in California

Of the several species of trombiculid mites (chiggers, jiggers, or harvest mites) which have been collected in 20 counties of California, only two species, *Eutrombicula alfreddugesi* (Oudemans) and *E. batatus* (Linnaeus), have been known in the past to attack man. A third species, *E. belkini* (Gould), has recently been added to this list. Up to the present *E. alfreddugesi* and *E. belkini* have been collected only in Los Angeles County, whereas *E. batatus* has been recovered from human hosts in both Tulare and Kern Counties.

These "chiggers," as they are more commonly called, are actually larvae, or the first immature stage of soil-inhabiting mites. On man, they appear as barely visible red dots within the center of the wheal caused by their bites. These bites frequently appear on parts of the body where clothing fits tightly, such as the waist, arm pits and stockinged ankles. An infestation of chiggers may be acquired from sitting on, lying upon, or merely walking through infested areas such as lawns, weeds, and brush of vacant lots or hillsides. This infestation is, therefore, one of contact in such areas, particularly during the late spring, summer, and autumn months.

Although they are at present not known to be vectors or reservoirs of any disease, their role as such should not be entirely overlooked. Their bites alone make them an annoying pest to man and this is considered as their present public health importance.

In the three counties where chiggers have been found to attack man, their occurrence appears to be rather discontinuous. Reservoirs of infestation have been attributed to their occurrence on both domestic and wild animals such as dogs, cats, chickens, rodents, birds, and reptiles. Aside from these species, other members of the family Trombiculidae have been collected from a wide variety of animal hosts. Among these hosts are reptiles, amphibians, birds, and a large number of mammalian species including deer, dogs, cats, ground squirrels, beaver, rabbits, bats, shrews, rats and mice.

The 20 counties where chiggers from these hosts have been collected in California are: Alameda, Contra Costa, El Dorado, Imperial, Kern, Lake, Los Angeles, Marin, Modoc, Mono, Monterey, Napa, Orange, Plumas, Riverside, San Diego, Santa Cruz, San Luis Obispo, Siskiyou, and Yolo. With such a widespread distribution throughout California and with an understanding of the host habits of these chiggers, it would not be surprising to encounter them attacking man in regions other than those mentioned above.

An infestation of the chiggers is acquired only by man's intrusion upon their habitat. The best way, therefore, to escape being bitten is to refrain from sitting or lying down in infested areas or to completely avoid such areas during the warmer months of the year. There are available, however, effective repellents which can be used on both skin and clothing to ward off chiggers. Among these are dimethylphthalate, dibutylphthalate, and Rutgers-612. It has also been advised that effective control of chiggers in the grass and brush around homes can be obtained by the use of benzene hexachloride (12 percent gamma isomer) applied at the rate of 25 pounds to the acre (one pound per 1,600 square feet).

New Chief of Children's Bureau Proposes Program Goals

Dr. Martha M. Eliot, who last month succeeded Miss Katherine Lenroot as Chief of the U. S. Children's Bureau, in assuming office set forth the following goals for the welfare of children:

1. Let us take vigorous steps to decrease the number of prematurely born infants and to save many more of those who are prematurely born. This is the biggest front remaining in the battle to help all our babies live safely through their first year of life. It means better maternal care, as well as better infant care.
2. We must make sure that each mother not only comes through the maternity period alive, but with abounding health for herself and her child.
3. I hope we can wipe out the "black market" in babies. We know what good adoption laws and practices are, and we have demonstrated how effectively they can protect the rights of the child, his natural parents, and his adoptive parents. Let's get them operating and used everywhere.
4. We must tackle the problem of preventing all kinds of congenital defects, find ways of preventing them, and improve our techniques in helping children to overcome the handicaps that cannot be prevented. This calls for more research and for spreading knowledge about preventives that we already have. No "blue" baby should go without surgical care if it will help him.
5. Let us step up our work for children with epilepsy and other chronic conditions. With the new diagnostic and treatment practices we have right now for epilepsy, we could enable 80 percent of children with epilepsy to lead normal, useful lives if we were to make sure that everyone got the proper treatment and care.
6. We must determine to do a great deal more for the many thousands of children who do not hear or see well. Ways and means are known. They call for combined action of parents, doctors, teachers, psychologists, and social workers. We need hearing and speech centers accessible everywhere to children with impaired hearing.
7. We must get a great deal more skilled help to children before they get into trouble with society. This means building up our social and health services for children in their own homes and communities. We already know much about the emotional problems which lead many children along the road to juvenile courts. It is time we applied this knowledge to prevent juvenile delinquency.
8. Let us wipe out every trace of brutal, degrading, and harsh treatment of youngsters in our training

schools, and substitute informed and intelligent handling of these children so that they are helped to fit into society instead of fighting it all their lives.

9. Let us see how many parents, doctors, nurses, social workers, teachers, and other children's workers can be helped to understand what is known about the emotional and social development of children, so that they can put this knowledge into their everyday dealings with parents and with children. We should start on this job in the doctor's office; in maternity and child health clinics; in nursery schools and day nurseries.

California Receives 31 Grants for Heart Disease Research

U. S. Public Health Service grants which total $3,038,418 will go to 88 medical schools, hospitals, research institutions and private individuals in 32 states, the District of Columbia and Puerto Rico in support of basic and clinical heart research. California will receive 31 of the 238 grants announced by Dr. Leonard A. Scheele, Surgeon General of the Public Health Service. Funds involved in the California awards total $411,482.

"These grants show that sustained nation-wide research into heart disease is underway on a broad scale," Dr. Scheele said in commenting on the awards. "The studies form a developing pattern of both basic and clinical investigation directed against the leading cardiovascular problems or arteriosclerosis, hypertension, and reheumatic heart disease."

One California project of interest has been awarded to Mt. Zion Hospital, San Francisco, for continued research in the application of a mechanical heart-lung apparatus to maintain circulation in place of normal heart action, a process which would be of extreme value during surgical crises.

California research grants are as follows:

City and institution	Investigator	Description of project	Grant amount
Berkeley			
Cal., Univ. of	Gofman, John W.	Fundamental biochemical and biophysical factors in development of hardened arteries.	$81,000
	Okey, Ruth	Study of protein intake in relation to food cholesterol retention in tissue.	7,991
La Jolla			
Scripps Metabolic Clinic	Bartlett, Grant R.	Metabolism of the red blood cell	12,739
Los Angeles			
Cal., Univ. of Sch. of Med.	Bassett, Samuel H.	Effect of ACTH and cortisone on course of congestive heart failure.	14,406
	Clark, William G. Warren, Stafford L.	Study of the physiological pathways of presser amine drugs in subjects with normal and high blood pressures.	10,000
	Valentine, Wm. N. Lawrence, John S.	Biochemical and enzyme studies of blood components in health and disease states.	7,923
Los Angeles—continued			
Cedars of Lebanon Hospital	Lippman, Richard W.	Mechanism and specificity of protein in urine.	$13,300
	Marmorston, Jessie	Studies of hormonal and kidney processes involved in experimental hypertension and shock.	30,240
So. Cal., Univ. of Sch. of Med.	Butt, Edward M.	A study of heavy metal storage in organs by spectographic and chemical analysis, with particular attention to blood and heart disorders.	6,768
	Deuel, Harry J.	Role of cholesterol metabolism in hardening of the arteries.	18,468
	Drury, Douglas R.	Studies in 1) experimental hypertension; and 2) the relation of partial blocking of an artery to the nourishment of tissues supplied by it.	17,492
	Hyman, Chester	Factors which control blood vessel permeability and filtration.	10,000
	Martin, Helen E.	Movement of body magnesium in heart disease.	4,995
	Marx, Walter	Fate of cholesterol in the animal body.	6,264
	Marx, Walter	Relationship of the thyroid hormone to the metabolism of cholesterol and the development of hardening of arteries.	7,020
	Moore, Frederick J.	Biochemical basis for ACTH therapy.	26,730
	Saunders, Paul R.	Metabolic studies on heart tissue	5,400
Oakland			
Highland-Alameda County Hospital	Kinsell, Laurence	Studies of metabolism of fatty compounds in the body.	21,400
San Francisco			
Cal., Univ. of, Hospital	Aird, Robert B.	Development of techniques for studying the transport of fluid nutrients through vessel walls. Development of agents to decrease this permeability of vessel walls.	5,600
	Hopper, James Brown, Ellen	Study of blood dynamics and fluid balance in heart failure.	10,342
	Lagen, John B. Tucker, Arthur S.	Studies of heart disease with electrokymograph, including determination of heart output in angina pectoris before and after treatment.	10,759
	Olney, Mary B.	Production of congenital heart lesions in mice.	7,369
	Page, Ernest W.	Chemical mechanisms affecting convulsions of pregnancy.	5,805
Cal., Univ. of Med. Center	Eiler, John J.	Influence of drugs on consumption of oxygen by rat tissue.	5,983
Cal., Univ. of Sch. of Med.	Rinehart, James F.	Studies of the origin and development of arteriosclerosis.	20,245
	Sokolow, Maurice Harris, Robert	A study of the natural history of hypertension and the psychodynamics of the hypertensive person.	9,814
Mt. Zion Hosp.	Leeds, Sanford E.	Application of a mechanical heart-lung apparatus to maintain circulation in place of heart.	10,838
Stanford Univ.	Grant, Ronald	Effect of bacterial fever inducers on factors in heart failure.	6,500
	Rantz, Lowell A.	Relationship of rheumatic fever to hemolytic strep infections in childhood.	10,000
	Rather, Lelland J.	Experimental development and study of hypertension and associated vascular lesions by kidney constriction in animals.	3,931
	Rytand, David A.	Study of abnormal patterns of urinary excretion in patients with heart failure.	2,160

Civil Service Examinations

San Bernardino

The San Bernardino County Health Department has a vacancy for a *Public Health Medical Officer* to conduct the school health program. Public health training is preferred. Applicants must be eligible for California license to practice as a physician and surgeon. Salary is $507 per month, with an increase to $647 after six months. Mileage (7 cents) is provided. Applicants should write to County Civil Service, 236 Third Street, San Bernardino.

San Diego

A civil service examination for *Mental Health Consultant* will be held by the San Diego County Department of Civil Service and Personnel (date to be set). Employment is to be in the San Diego Health Department. Applicants must hold a California license to practice as a physician and surgeon and a certificate issued by the American Board of Psychiatry and Neurology. Salary is $713 to $786. Further information is available from Gordon W. Peterson, Director of Personnel, Department of Civil Service and Personnel, Room 402, Civic Center, San Diego.

Santa Cruz

The Santa Cruz County Department of Public Health has a vacancy for a *Public Health Nurse*. Salary range is $290 to $348. Mileage (8 cents) is provided. Applications should be directed to Miss Theta Cole, P.H.N., Director of Nursing, Department of Public Health, 842 Front Street, Santa Cruz.

Completed 1950 Population Figures Listed by County for State

California's population as of April 1, 1950, totaled 10,586,223 persons, according to completed census figures recently released. This shows a gain in population for the State of 53.2 percent over 1940, which now makes California the second most populous state in the Nation. Four of the isolated counties in the high Sierra lost population during the decade, but the other 54 counties showed gains ranging up to 113 percent.

In numbers, Los Angeles County shows the most impressive gain, increasing its population by 1,366,792 persons in the 10 years—to a 1950 figure of 4,151,687. The population centers of the San Francisco Bay area and San Diego also show tremendous growth.

The completed census figure is higher by 113,875 noses than the preliminary figure of 10,472,348 announced in *California's Health* last December.

The following table gives the breakdown of popula tion by county and shows percentage change. Fina figures for cities have not yet been released, but shoul be available in two or three months.

Population: California Counties
1940 and 1950

County	Population as of April 1		Percent change
	1940	1950	
California	6,907,387	10,586,223	53.2
Alameda	513,011	740,315	44.3
Alpine	323	241	—25.4
Amador	8,973	9,151	2.0
Butte	42,840	64,930	51.6
Calaveras	8,221	9,902	20.4
Colusa	9,788	11,651	19.0
Contra Costa	100,450	298,984	197.6
Del Norte	4,745	8,078	70.2
El Dorado	13,229	16,207	22.5
Fresno	178,565	276,515	54.9
Glenn	12,195	15,448	26.7
Humboldt	45,812	69,241	51.1
Imperial	59,740	62,975	5.4
Inyo	7,625	11,658	52.9
Kern	135,124	228,309	69.0
Kings	35,168	46,768	33.0
Lake	8,069	11,481	42.3
Lassen	14,479	18,474	27.6
Los Angeles	2,785,643	4,151,687	49.0
Madera	23,314	36,964	58.5
Marin	52,907	85,619	61.8
Mariposa	5,605	5,145	—8.2
Mendocino	27,864	40,854	46.6
Merced	46,988	69,780	48.5
Modoc	8,713	9,678	11.1
Mono	2,299	2,115	—8.0
Monterey	73,032	130,498	78.7
Napa	28,503	46,603	63.5
Nevada	19,283	19,888	3.1
Orange	130,760	216,224	65.4
Placer	28,108	41,649	48.2
Plumas	11,548	13,519	17.1
Riverside	105,524	170,046	61.1
Sacramento	170,333	277,140	62.7
San Benito	11,392	14,370	26.1
San Bernardino	161,108	281,642	74.8
San Diego	289,348	556,808	92.4
San Francisco	634,536	775,357	22.2
San Joaquin	134,207	200,750	49.6
San Luis Obispo	33,246	51,417	54.6
San Mateo	111,782	235,659	110.8
Santa Barbara	70,555	98,220	39.2
Santa Clara	174,949	290,547	66.1
Santa Cruz	45,057	66,534	47.7
Shasta	28,800	36,413	26.4
Sierra	3,025	2,410	—20.3
Siskiyou	28,598	30,733	7.5
Solano	49,118	104,833	113.4
Sonoma	69,052	103,405	49.7
Stanislaus	74,866	127,231	69.9
Sutter	18,680	26,239	40.5
Tehama	14,316	19,276	34.6
Trinity	3,970	5,087	28.1
Tulare	107,152	149,264	39.3
Tuolumne	10,887	12,584	15.6
Ventura	69,685	114,647	64.5
Yolo	27,243	40,640	49.2
Yuba	17,034	24,420	43.4

SOURCE: United States Department of Commerce, Bureau of the Census, 194 and 1950 Census Reports.

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